Rapid Mortality Monitoring during heatwaves

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Outline

• Heatwaves
• Mortality data-flow – estimating current mortality
• Setting baselines and limits – expected mortality
• The 2009 Heatwave
• Comments & future plans
Introduction
The 2003 Heatwave
2003 Heatwave

- Record UK temperature of 38.5c (101.3 f)
- 45,000 excess deaths in Europe in August 2003 (2,000 in UK, 15,000 France) when comparing to summers before and after*
- Also evidence Ozone pollution played a role – but hard to separate from temperature.
- Many countries made Heatwave plans

*http://ec.europa.eu/health/ph_information/dissemination/unexpected/unexpected_1_en.htm
The Heatwave Plan for England

• Heatwaves set to become more common

• Short term plans
  – Identify vulnerable populations
  – Moving patients in hospitals
  – Identify vulnerable infrastructure (food storage/computer servers..)
  – Providing information / advice to public

• Long terms plans
  – building homes / hospitals,
  – Transport

• Alert levels
  1. All summer
  2. 60% chance of heatwave within 2-3 days
  3. Heatwave thresholds reached
  4. heatwave for 4 or more days in 2 or more regions
Main health effects of heat

• Respiratory disease (pollution)
• Cardiovascular disease (extra blood needs to be circulated to the skin to keep cool – strain on the heart)
• Both of these can lead to death
# Heatwave definition

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The 2009 Heatwave

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? What was the impact on Mortality
Rapid Mortality Monitoring

• Enable rapid assessment of the impact of a heatwave
• Enable assessment of the effect of interventions
Excess mortality

• Expected deaths for that time of year under ‘normal conditions’
• Actual deaths for the days of the heatwave
• Excess = Actual - Expected
• Simple?
Estimating the number of deaths that have occurred (Actual deaths)
Deaths registrations in E & W – data flow

- **Relatives**
  - Legal requirement to register death within 5 days

- **Clinicians**

- **Local registrars**

- **Inquest**
  - Long delays

- **Home Office Identity and Passport Service (General Registry Office)**
  - Online registration (100% since July 1st 09)

- **Office for National Statistics**

- **Public**

- **DoH / HPA**
  - Extract each day of registrations previous day by date of death, age (years) and registration district
Delay from death to registration

• Delays vary greatly by age
• In the short term they also depend on the day of the week of death (weekend effect) and holidays.
• No sensible estimate for a given day is possible for at least 3 working days.
• Deaths either get reported within about 10 days or they fall into a group that can takes many months (coroner’s inquests).
Delays by age within the first month

Days delay

Cumulative %
Delays by day of the week
Correcting for delays

- Suppose from past data we know that 80% of deaths in those aged 65+ that happen on a Friday are registered by the next Wednesday.
- Then if we have observed 1000 deaths by Wednesdays we estimate a final total of $1000/0.8=1250$.
- In a similar way we corrected deaths from April 28th 2009-June 30th 2009 by the estimate of the proportion of deaths reported online.
Expected Deaths

- Use daily data from 1999-2008 for England and Wales by age/region (ONS data)
- Fit a statistical model (Serfling).
  - Poisson regression model, rescaled for overdispersion and refitted twice with outliers down weighted to reduce the effect of previous excesses (e.g. influenza epidemics).
- An upper prediction limit is added
Baseline for all deaths (weekly model)
The heatwave of June 30th – July 2nd 2009

• What we did at the time
• Retrospective analysis
• Regional analysis
What we did at the time

• July 1\textsuperscript{st} and 2\textsuperscript{nd} (Thursday/Friday) 2009 heatwave alert

• On July 6\textsuperscript{th} we did an analysis using all registrations reported by July 5\textsuperscript{th} (the Monday)

• This appeared to show an excess
Apparent Excess late June/ early July 2009
trend line is fitted to observed data

RON deaths in over 65s by date of death with correction for reporting delay and RON coverage
using registrations to July 5th 2009

Trend line fitted to allow for changes in baseline deaths or RON coverage
Apparent Excess late June/ early July 2009

- At that time we did not know whether all registry offices were reporting.
- We knew the number reporting was increasing and this could explain the recent rise.
- A few days later we were told reporting had increased from 80% to 100% on July 1st!!
- We corrected for this and things looked quite different!
Figure 2: RON deaths in over 65s and under 65s by date of death with correction for reporting delay and RON coverage using registrations to July 13th 2009. Central England maximum temperatures are also shown.

Excess June 30th to July 2nd = 246
Final Model using data to the end of March 2010 and expected from historical model

Observed and expected mortality in persons aged 65+ years
England and Wales, 15th June – 15th July 2009

Excess June 30th – July 2nd approx 200 -300
AGE 65-74

Observed and expected mortality in persons aged 65 to 74 years
England and Wales, 15th June – 15th July 2009
AGE 75-84

Observed and expected mortality in persons aged 75 to 84 years
England and Wales, 15th June - 15th July 2009

- Observed
- Expected
- 97.5% upper limit
- 99.5% upper limit

Daily deaths

Time

Observed and expected mortality in persons aged 85+ years
England and Wales, 15th June – 15th July 2009

AGE 85+
Comments on the heatwave

- About 200 -300 excess deaths in the heatwave
- The estimated 1093 deaths in those aged 65+ on July 2\textsuperscript{nd} 2009 was the highest number for any day between June 1\textsuperscript{st} and August 30\textsuperscript{th}
- The estimate made shortly after the heatwave remained similar to current update.
- Seemed to effect the 75+ most
- A small decline the few days after but not enough numbers to determine a harvesting effect.
- Unlikely to be due to Pandemic Flu as this was at very low levels in the Elderly at this time and did not show clear excess mortality in any age group through the pandemic
Future plans

• Daily data flow has stopped
• If a heatwave is forecast it will restart
• We are working on regional models – (excess was too small in 2009 to see a clear regional pattern)
• Establish continuous data flow for heat / cold/ influenza and Olympics 2012.
Acknowledgements

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